



EGUsphere, referee comment RC1
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Comment on egusphere-2022-857

Anonymous Referee #1

Referee comment on "Bayesian parameter inference in hydrological modelling using a Hamiltonian Monte Carlo approach with a stochastic rain model" by Simone Ulzega and Carlo Albert, EGU Sphere, <https://doi.org/10.5194/egusphere-2022-857-RC1>, 2022

General comments

The paper presents a Bayesian framework for forward and inverse problems in stochastic rain models based on time series observations of rainfall-runoff. The focus of the paper is on HMC as a scalable inference method. The paper provides a detailed study of the hydrological problem, giving a detailed description of the model, the parameters, and the priors. The discussion of the results is convincing.

Specific comments

- It would be good to explicitly list the contributions, making it easier for the reader to see the high-level differences between this paper and Albert et al. (2016).
- I wanted to clarify some of the results. Looking at Fig. 5-6 for predictions, it seems that the discharge data alone is mostly enough to provide good predictions for the rainfall. Is that generally true? How good would be the estimates of the parameters, and the predicted rainfall if you had no rain observation data? Would it be better or worse than the low-quality data of Sc2?
- In Fig 3, you show that with a more accurate dataset (Sc1) the estimates of the parameters are more sharply peaked (less uncertain), which makes sense. There seems to be a mismatch for some of these parameters, e.g. λ and γ . I guess the problem of inferring γ and λ jointly is ill-posed as they both define the transformation. If so, that could be an interesting point to discuss.
- I'm also generally curious what is the end goal of this study, for example, can these results be used to aid policy making? Are quantities like groundwater flow, or retention time important to know for planning purposes? Would there ever be a need to run a system like this in real-time?

Technical comments

- Some references need fixing, e.g. Line 510, some papers are missing titles.
- Line 290: construct e reversible -> construct a reversible